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EPICS PERSONAL COMPUTER EVALUATION

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ABSTRACT

This document is an evaluation of five personal computers to be used as intelligent terminals on the beamline control system (EPICS). It is not intended to be a general comment on the computers themselves. Rather, it is an evaluation of these computers for a specific need. Nevertheless, this document should be useful for those considering the acquisition of a personal computer.

The five computers included here are:

1. IBM-PC
2. DEC Rainbow
3. DEC PRO-350
4. HP 150
5. Tandy TRS-80 Model 2000

The evaluation consists of a comparison of the personal computers using the following criteria:

1. GRAPHICS: color monitor, color pallette(s), graphics resolution.
2. MEMORY: diskette storage, RAM memory.
3. CPU
4. EXPANDABILITY
5. BASIC: Features of the BASIC interpeter used.
6. COMMENTS: General comments on what was not covered above.
7. PRICE (including discounts).
8. ADVANTAGES/DISADVANTAGES: Summary of the pros and cons of each.
9. BENCHMARKS: Timings of each computer.
10. RECOMMENDATION

All of the machines reviewed here had two things in common:

1. A wide variety of languages and other software are available.
2. Only 64K of memory was directly addressable from BASIC.

Since all machines were roughly eqivalent in these respects, they are omitted in this evaluation. Some others are not included, e.g., Apple IIE and MacIntosh, because of known low resolution graphics or only monochrome availability.

1.0 GRAPHICS

1. IBM-PC

   Resolution: 320x200 in medium-res graphics mode.
   640x200 in high-res mode.
   Color: No colors in high-res mode.
   4 colors in medium-res (non-RGB). 16 in text mode.

2. DEC Rainbow

   Resolution: 320x240 in medium-res graphics mode.
   800x240 in high-res.
   Color: 16 in medium-res mode. 4 from 8 (RGB) in high-res.

3. DEC PRO-350

   Resolution: 960x240 in graphics mode.
   Color: 8 from 256 in graphics mode.

4. HP 150

   Resolution: 512x390
   Color: None

5. Tandy TRS-80 Model 2000

   Resolution: 640x400 in graphics mode.
   Color: 8 from 16 in graphics mode.

2.0 MEMORY

1. IBM-PC

   64kb RAM memory standard, expandable to 256kb; one (1) 360kb diskette drive standard, expandable.

2. DEC Rainbow

   64kb RAM memory standard, expandable to 256kb; two (2) 400kb diskette drives standard.

3. DEC PRO-350

   256kb RAM memory standard, expandable to 1Mb; two (2) 400kb diskette drives standard.

4. HP 150

   256kb RAM memory standard, expandable to 640kb; two (2) 270kb diskette drives standard;

5. Tandy TRS-80 Model 2000

   128kb RAM memory standard, expandable to 768kb; two (2) 720kb diskette drives standard.

3.0 CPU

1. IBM-PC: 8088 at 4.7 MHz
2. DEC Rainbow: 8088/Z80 at ? hertz
3. DEC PRO-350: LSI-11/23 Plus at ? hertz
4. HP150 - 8088 at 8 MHz
5. Tandy TRS-80 2000: 80186 at 8 MHz

4.0 EXPANDABILITY

Listed here are I/O ports and card slots available for expansion. (Available for expansion means it was unused after the basic system was configured.)

1. IBM: One RS-232 port and two card slots
2. Rainbow: One RS-232 port and three card slots
3. PRO-350: One RS-232 port and four card slots
4. HP150: Two RS-232 ports and two card slots
5. Tandy: One RS-232 port and three card slots

5.0 BASIC

1. IBM-PC

Type:	Microsoft
Graphics:	Primitives built into the BASIC.
Extendable:	Has Call statement for interfacing to assembly language routines.
Real-time:	Basic program can be interrupted by RS-232 port.
Other:	Graphics characters are only one size (large). Has BASIC support for joy stick and mouse.

2. DEC Rainbow

Type:	GWBASIC (available in April)
Graphics:	Primitives built into the BASIC.
Extendable:	Has Call statement for interfacing to assembly language routines.
Real-time:	Basic program can be interrupted by RS-232 port.
Other:	Selectable text sizes. No support for joy stick or mouse.

3. DEC PRO-350

Type:	DEC PRO BASIC.
Graphics:	Primitives built into the BASIC.
Extendable:	No.
Real-time:	No.
Other:	Selectable text sizes. No support for joy stick or mouse.

4. HP 150

Type:	Microsoft
Graphics:	No primitives built into the BASIC.
Extendable:	Has Call statement for interfacing to assembly language routines.
Real-time:	No.
Other:	Selectable text sizes. No support for joy stick or mouse.

5. Tandy TRS-80 Model 2000

Type:	Microsoft
Graphics:	Primitives built into the BASIC.
Extendable:	Has Call statement for interfacing to assembly language routines.
Real-time:	Basic program can be interrupted by RS-232 port.
Other:	Graphics characters are only one size. Has BASIC support for joy stick and mouse.

6.0 COMMENTS

1. IBM-PC

   Awkward keyboard. Good second party sources. The screen has a very irritating flicker when eighty characters per line are displayed. This can be overcome by only displaying forty characters per line.

2. DEC Rainbow

   Unfamiliar keyboard.

3. DEC PRO-350

   Unfamiliar keyboard, nice graphics.

4. HP 150

   Touchscreen is very nice. Nice keyboard. Good monochrome graphics. Compact.

5. Tandy TRS-80 Model 2000

   Best graphics reviewed. ON COM statement does not trap correctly with present BASIC but new release of BASIC should correct problem. Good keyboard. Good primary party source.

7.0 PRICE (Including Discounts)

1. IBM-PC (20%)

   System unit, keyboard, ROM BASIC, one diskette drive, $2104; color monitor, $680; second diskette drive, $528; operating system, $60; bit-mapped graphics, $244; upgrade from 64kb to 128kb RAM, $396.

   Total, $4012.

2. DEC Rainbow (26%)

   System unit, two (2) 400kb diskette drives, $2035; keyboard, $181.30; color monitor, $703; bit-mapped graphics, $333; operating system, $129.50; upgrade to 128kb RAM, $366.30; GWBASIC, $????.

   Total, $3748.10.

3. DEC PRO-350 (26%)

   System unit, two (2) 400kb diskette drives, $3681.50; keyboard, $181.30; color monitor, $703; bit-mapped graphics, $662.30; operating system, $129.50; PRO/BASIC, $236.80.

   Total, $5594.40.

4. HP 150

   No prices requested since only monochrome available.

5. Tandy TRS-80 Model 2000 (20%)

   System unit, keyboard, two (2) 720kb diskette drives, operating system, $2256.41; color monitor, $655.59; bit-mapped graphics, $562.46.

   Total, $3474.46.

8.0 OVERALL ADVANTAGES AND DISADVANTAGES.

1. IBM

   The primary (if not the only) advantage of the IBM is the second party sources. There are a wide variety of both hardware and software products available. The primary disadvantages are the low graphics resolution (the worst of those reviewed) and the speed (only the Rainbow was as slow).

2. DEC Rainbow

   Aside from the existence of a second CPU (Z80) for compatibility purposes, there are no real advantages of the Rainbow over the others reviewed. However, The GWBASIC, when it is released, may prove to be interesting. The main disadvantage is the speed, which was comparable to the IBM.

3. DEC PRO-350

   The advantages of the PRO-350 are two-fold. First is the graphics. Of those reviewed, only the Tandy had higher resolution graphics. But the PRO-350 had a wider variety of colors to choose from (up to 256 although only 8 may be used at one time). The second advantage is that its central processor is a PDP-11. This could allow for access to the very large library of PDP-11 software already in existance.

   The main disadvantage is the price. The PRO-350 was by far the most expensive reviewed.

4. HP150

   The main advantage of the HP was the touch screen. The main disadvantage is the lack of a color monitor.

5. Tandy TRS-80 Model 2000

   The advantage of the Tandy is clear. In almost every way, it out performed all the others reviewed (including in graphics and speed). And it does it for less money. The notable exception to this was that the RS-232 port would not correctly interrupt a BASIC program. Tandy is aware of this and promises that this problem will be corrected in the next release of their BASIC. In all other respects, however, it performed as documented.

9.0 BENCH MARKS

The following bench mark programs were conducted by the Accelerator Division to which we owe thanks for their figures. They illustrate the time it took to execute nine identical programs on each machine in question. (An exception is the HP150 which was not available at the time of the test. During other tests, the HP did slightly better than the IBM.) The programs used in the bench marks are included in this document.

	Benchmark times (in seconds)								
Test #	1	2	3	4	5	6	7	8	9
TANDY	0.5	2.6	4.6	4.8	5.4	9.4	14.1	10.9	15.6
PRO-350	1.1	4.6	10.2	10.6	12.4	20.7	33.0	33.9	52
IBM	1.3	5.4	12.2	12.8	14.0	23.9	37.9	28.7	42.6
Rainbow	1.9	5.6	11.4	11.8	13.8	25.5	39.1	29	42

10.0 RECOMMENDATION

Of the five personal computers covered in this evaluation, two met more of the requirements than the others. These were the IBM-PC and the Tandy TRS-80 Model 2000. However, the IBM had some serious deficiencies when compared with the Tandy. In almost every criteria, the Tandy either equalled or surpassed the IBM. Among these were the graphics capabilities, the speed of the computers, and the memory available. The one advantage IBM has over the Tandy was the second party sources for both hardware and software. However, Tandy has in the past for all their computers been a very good primary source. And there is no reason to believe that the Model 2000 would be an exception to this. They were also the first company to bring out a complete microcomputer system in 1977.

It is for these reasons that we recommend the acquisition of the TANDY TRS-80 MODEL 2000 for a beamline intelligent terminal.